DOCUMENT RESUME

ED 234 154 CE 036 789

AUTHOR Welch, Antoinette Wojciak; McCracken, J. David
TITLE Readability of Vocational Horticulture Instructional Materials. Summary of Research 31.
INSTITUTION Ohio State Univ., Columbus. Dept. of Agricultural Education.
PUB DATE 83
NOTE 20p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Academic Achievement; *Agricultural Education; *Difficulty Level; *Horticulture; *Instructional Materials; Questionnaires; *Readability; Secondary Education; State Surveys; Teacher Characteristics; Teaching Experience; Textbook Evaluation; Vocational Education
IDENTIFIERS Dale Chall Readability Formula; Ohio

ABSTRACT

A study examined the readability of vocational horticulture instructional materials used by 40 schools participating in the 1981 Ohio Horticulture Achievement Testing Program. During the first part of the study, researchers administered a mail questionnaire to 31 teachers to identify the materials that were used most frequently, to obtain descriptive data about the teachers, and to collect teacher estimates of the readability of the materials being used. Next, the researchers utilized the Dale-Chall Readability Formula to estimate the readability of 75 instructional materials. The analysis revealed that difficult vocabulary constituted from 16 to 29 percent of the vocabulary included in the sample texts. As did previous researchers, the designers of this study found only a nonsignificant correlation between readability scores and frequency of use. Because of the very low degree of association found between the respondents' length of teaching experience and the readability of the instructional materials that they used, the researchers concluded that increased teacher experience does not increase instructors' ability to estimate readability. In general, teacher estimates of student ability matched their estimates of the readability of instructional materials. In most cases, however, teachers underestimated the reading difficulty of materials as it was determined according to the Dale-Chall formula. (MN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

SUMMARY OF RESEARCH

DEPARTMENT OF AGRICULTURAL EDUCATION

The Ohio State University
Columbus, Ohio 43210

READABILITY OF VOCATIONAL HORTICULTURE INSTRUCTIONAL MATERIALS

ED234154

Antoinette Wojciak Welch and J. David McCracken

SEP 29 1983

INTRODUCTION

Readability is the sum of all those elements within a given piece of printed material that affects the success which a group of readers have with it. The success is the extent to which they understand it, read it at optimum speed and find it interesting (Dale & Chall, 1948).

Readability is a major concern of educators today. Reading problems and declining reading scores at some levels have received much publicity. Consequently, improvement of reading skills is a high priority in many secondary schools.

There are many causes for reading difficulties among students; one of these is the incompatibility between the reading abilities of students and the readability levels of instructional materials.

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)"

READABILITY OF VOCATIONAL HORTICULTURE INSTRUCTIONAL MATERIALS

The relationship between academic achievement and the ability to read assigned materials has long been acknowledged. Reading and comprehension are important factors in school success. Bormuth (1969, p. 3) agreed that a student's ability to comprehend the language in instructional materials was one of the most basic factors determining the effectiveness of instruction. He stated that much of the knowledge contained in the curriculum was transmitted through written language. Students unable to understand that language frequently failed to learn much of the content of instruction, and both students and instruction therefore failed to attain the desired objectives.

Bond and Tinker (1957, p. 35) summarized a discussion of reading difficulties by stating that to require students to read incomprehensible materials would only result in confusing them. Beldon (1962) agreed that if course materials were on a level above the reading skill of students, frustration, anxiety and failure would result. Felsenthal (1973) added that desire to read was invariably reduced when material was too difficult and that a definite need to evaluate materials as to readability was clearly indicated.

Bentley and Galloway (1961) concluded that vocational agriculture students had mean reading abilities which ranged from 0 to 3 grade levels below their peers as represented by publisher's norm groupings, and that in general agricultural reference books used by students were too difficult for their reading ability. They noted that most of the books had mean readability scores higher than the mean reading ability of students.

PURPOSE AND OBJECTIVES

The study was designed to gather data concerning readability of instructional materials used in Ohio vocational horticulture programs. The objectives of the study were:

1. To determine what printed materials were most frequently assigned to students of vocational horticulture in Ohio.
2. To predict readability levels of the most frequently used horticulture instructional materials.
3. To estimate the percentage of technical terms and other difficult words in the materials used most frequently.
4. To determine the similarity between reading difficulty rank and popularity rank of instructional materials.
5. To determine if teachers were aware of the readability of materials they selected.
6. To determine the relationship between teacher experience and the selection of appropriate materials.
7. To examine the relationship between teacher estimates of readability and teacher estimates of the reading ability of students.
8. To examine performance of students on standardized tests of aptitude and achievement.
9. To determine the relationship between the readability of the instructional materials used most frequently and student achievement as measured by scores on the statewide horticulture achievement test.

10. To compose an annotated bibliography of horticulture instructional materials and a glossary of technical terminology used in horticulture.

METHODOLOGY

This study was designed in two parts: (a) a survey portion, and (b) a descriptive analysis of data. The compilation of an annotated bibliography and a glossary were end products of the study.

The survey portion of the study was designed to determine the materials which were being used with the highest frequency. In addition the survey provided information regarding the degree to which vocational horticulture teachers could assess the readability of instructional materials. This was determined by a comparison of teacher estimates of reading level difficulty and the reading level as determined by a readability formula.

The target population for the study was the 40 schools participating in the 1981 Ohio Horticulture Achievement Testing program. Data were collected following a pilot test of the survey instrument. A total of 31 teachers responded to the mailed questionnaire. A sample of 4 non-respondents was visited and interviewed. There was no apparent difference between interviewed respondents and mail respondents.

The 17-item questionnaire was organized into three parts. Part one provided brief descriptive data about teachers. Part two requested teachers to list and evaluate the readability of instructional materials their students used frequently. Part three of the questionnaire asked teachers to give their opinions concerning the reading ability of their students and to summarize their estimates regarding readability of materials.

In the descriptive analysis portion of the study descriptive statistics were used to describe characteristics of the samples. Spearman and Pearson correlation coefficients were used to analyze relationships.

Instructional materials were ranked first according to their frequency of usage, then by readability scores. Reading levels of the materials were estimated using the Dale-Chall Readability Formula. Mean, range and standard deviation of the samples were computed. Materials were ranked and the Spearman rank-order correlation coefficient was computed for the most frequently used materials on a per school basis. The score for each of the 35 schools was then used in comparing readability of instructional materials with student performance on statewide achievement tests.

Variables in the study were: (a) readability of horticulture instructional materials, (b) teacher experience, (c) materials selected for use, (d) teacher estimates of readability, and (e) student performance. Classroom means were calculated for student variables.

Following the descriptive analysis of data, samples used to predict readability scores were further analyzed and lists made of difficult words not found on the Dale List of 3000 Words. The approximate percentage of technical terms for each item was also computed.

FINDINGS AND DISCUSSION

Data in Table 1 summarize the readability of the 75 instructional materials analyzed in the study. The majority of materials were written at Grade 11.

TABLE 1

NUMBER OF MATERIALS AT EACH GRADE LEVEL

Dale-Chall score	Number of materials	Percent materials
8	2	2.67
9	4	5.33
10	17	22.67
11	33	44.00
12	13	17.33
Over 12	6	8.00
Total	75	

mean = 10.9

The Spearman rank-difference correlation coefficient was calculated for the Dale-Chall score of materials and the frequency of use of these materials. A very low degree of association between readability scores and frequency of use indicated that readability was not a major factor in the selection of instructional materials.

Application of the Dale-Chall formula to the materials revealed minimal variation in terms of overall readability. However, as has been the case in numerous previous studies, the range of readability within each item was considerable.

A comparison of readability of instructional materials by type of publication revealed that popular periodicals and task sheets were the most readable materials used by Ohio vocational horticulture students.

An unexpected finding was the similarity of materials designed to be used with specific instructional program areas. When broken down into program areas turf materials were the most difficult in terms of readability with a mean Dale-Chall score of 12.0 and standard deviation of .2.

TABLE 2

COMPARISON OF READABILITY OF INSTRUCTIONAL MATERIALS BY INSTRUCTIONAL PROGRAM AREA

Program area	n	Mean	Standard deviation	Range	
				Minimum	Maximum
Turf	7	12.0	.21	11.6	12.2
Landscape	13	10.6	.70	9.1	11.5
Nursery	6	10.8	.42	10.3	11.5
Floriculture production	18	10.7	.72	9.2	11.9
Floriculture retail	9	10.7	.91	8.7	12.2
Equipment & mechanics	2	10.4	.30	10.1	10.7
Pest control	3	10.7	1.48	9.4	12.4
General horticulture	14	10.9	1.20	7.9	12.9
Miscellaneous areas	3	9.7	.86	8.5	10.5
Totals	75	10.7	.56	7.9	12.8

TABLE 3

AVERAGE NUMBER OF DIFFICULT TERMS BY PROGRAM AREA

Program area	n	Number difficult words	Percent difficult words	Number technical words	Percent technical words
Turf	2	144	21	39	6
Landscape	3	94	14	24	3
Nursery	4	122	17	22	3
Floriculture production	4	149	21	26	4
Floriculture retail	4	114	16	23	3
General horticulture	6	120	17	26	4
Total	N=23	$\bar{X}$=124	18	27	4

Materials for horticulture equipment and mechanics were the easiest with a mean score of 10.4 (Table 2).

The instructional materials most frequently listed by teachers were further analyzed to estimate the percentage of technical terms and other difficult words contained in the samples. This analysis indicated that the most frequently used items contained from two to seven percent technical vocabulary. Turf materials taken as a group were the most difficult in terms of technical vocabulary content. They contained an average of six percent technical terms (Table 3).

The number of technical terms and other hard, non-technical words in instructional materials has been found to be closely related to the reading difficulty of the material. The total number of difficult words in the samples ranged from a low of 16 percent to a high of 29 percent. The mean was 21.5 percent.

Respondents were asked to summarize their impressions of the readability of instructional materials in the final portion of the questionnaire (Table 4). The mean Dale-Chall readability scores of the materials used in the schools were then compared with mean teacher estimates of the reading difficulty of materials (Table 5).

TABLE 4

SUMMARY OF TEACHER READABILITY OPINIONS

Reading level of material	Number of teachers	Percent
Far too difficult	1	2.9
A bit too difficult	9	25.7
Appropriate	25	71.4
Too elementary	0	0.0
Total	35	100.0

TABLE 5

TEACHER ESTIMATES OF READABILITY

Mean Dale-Chall score	Number of teachers	Mean estimated score	Number of times difficulty over-estimated	Number of times difficulty under-estimated	Number of times difficulty accurately estimate.
9 to 10	14	11-12	30	30	29
11 to 12	21	9-10	19	88	62
Total	35		47	118	91

Teachers underestimated the reading difficulty of materials in 46 percent of the cases. That is, in almost half the cases teachers thought materials were more readable than formula derived scores would indicate.

The teaching experience of instructors was compared with the mean Dale-Chall score of materials used at each school. The Spearman rank-difference correlation coefficient calculated for years of teaching experience and mean Dale-Chall score indicated a very low degree of association between experience and readability of materials listed. It was therefore concluded that teacher experience was not a factor in the readability of materials listed as being used by teachers in their classrooms.

The Spearman rank-difference correlation coefficient (.299) was calculated for the categorized Dale-Chall score of the materials and teacher estimates of the reading difficulty of materials. A low degree of association indicated there was little relationship between material difficulty as predicted by the Dale-Chall formula and teacher estimates of the reading difficulty of materials (Table 6).

TABLE 6

TEACHER ESTIMATES OF READABILITY AND DALE-CHALL SCORES

Grade Level	Dale-Chall Score	Teacher Estimates of Readability
Below grade 7	0	1
Grade 7 to 8	0	0
Grade 9 to 10	2	16
Grade 11 to 12	33	15
Above grade 12	0	3
Total	35	35

The Pearson product-moment correlation coefficient (.036) for mean Dale-Chall scores and achievement test scores indicated a negligible degree of association between variables, leading to the conclusion that the readability of materials used by students had little bearing on scores students received on standardized tests of achievement (Table 7).

TABLE 7

READABILITY OF MATERIALS AND STUDENT TEST SCORES

Mean Achievement Score	n	Mean Dale-Chall Score	Number of Materials Listed
91-100	1	11.9	13
101-110	0	---	--
111-120	3	11.2	9
121-130	3	10.9	9
131-140	8	10.9	10
141-150	5	11.0	11
151-160	7	10.9	12
161-170	6	11.0	11
171-180	1	11.3	7
181-190	1	11.0	5
Total	35	$\bar{X}$=11.0	$\bar{X}$=10

Results of the California Short Form Test of Academic Aptitude (SFTAA) indicated that all classrooms included in the sample were performing at a level

below national 50 percentile norms. There was, however, considerable variation in scores of the 35 sample schools. A wide variation could also be predicted within each classroom. It was concluded that a statement concerning the degree of match between the readability of materials and the reading ability of students must be made on an individual basis. Materials may match the average ability of students in one classroom yet be highly inappropriate in another.

A comparison between classroom mean score on the Ohio Horticulture Achievement Test and the mean Dale-Chall score of materials used in that classroom revealed a negligible degree of association between the variables. This nonsignificant finding led to the conclusion that the readability of materials could not directly be associated with the performance of students on standardized tests. This finding could well be attributed to the fact that books and other printed materials are rarely read by students in isolation. Numerous extraneous variables impinge upon the reading environment and must be considered. For example, practices such as preteaching technical vocabulary, peer teaching, and teacher-led discussion of difficult passages can have a positive effect on the degree to which students understand what they read, and consequently their performance on tests.

CONCLUSIONS

A wide variety of instructional materials are used in the Ohio vocational horticulture programs. After delimiting the number of items analyzed in this study to 75 there was still a wide variety in terms of the type and scope of the materials used. Therefore, an obvious conclusion was that no one item or type of instructional material was acceptable to horticulture teachers as a group.

The finding of a substantial range of readability within individual items was consistent with the findings of previous studies by Miller (1962), Calhoun and Calhoun (1968) and others. In effect, even when the readability score of a given item matches the grade level of a given student that student could still have problems reading certain portions of the material.

In terms of difficult and technical vocabulary Aukerman (1972) found that difficult vocabulary constituted 15 percent or more of many readability samples from vocational text books. The findings of this study of from 16 to 29 percent difficult words was therefore not surprising. When using The Living Word Vocabulary (Dale & O'Rourke, 1976) to examine the degree of difficulty of the words not found on the Dale List of 3000 Words it became obvious that the majority of "difficult' words were recognizable by the majority of students reading at elementary or junior high school levels. Those terms defined as being technical in nature were generally less recognizable and therefore could tend to present more problems for students not having previous experience in the field of horticulture. For students with more experience in the field these technical terms would not offer special difficulty in the comprehension of materials.

The nonsignificant correlation between readability scores and frequency of use was consistent with findings of previous studies. The readability of materials is clearly only one factor to be considered by those involved with

the selection of instructional materials. The content and scope of an item, the appearance and format of the item, and undoubtedly the price of the item could well be of more significance to those involved in selecting materials.

Due to the very low degree of association found between the number of years of teaching experience of respondents and the readability of instructional materials listed by those respondents, it appeared that increased teacher experience did not increase the instructors' ability to estimate readability.

In general, teacher estimates of student ability matched their estimates of the readability of instructional materials. Teachers thought they were providing the majority of their students with appropriate materials. However, a low degree of association was found between teacher estimates of readability and the readability as determined by the Dale-Chall formula. In most cases teachers underestimated the reading difficulty of materials.

Classrooms involved in this study performed below national norms on aptitude tests. However, due to the range of scores involved, generalizations concerning academic aptitude would be difficult to make. More realistic judgments concerning student aptitude and ability could be made by looking at each case separately.

RECOMMENDATIONS

Helpful insight into aspects related to this study could be provided by the following:

1. Undertaking a needs assessment to determine what teachers look for when selecting materials would be helpful. What types of materials do horticulture teachers need? On what criteria do they base the selection of these materials?

2. Developing a validated technical vocabulary for vocational horticulture would be helpful. Teachers need to know which words to teach. Both industry people and educators should be involved with this. The Living Word Vocabulary (Dale & O'Rourke, 1976) could be used as a predictor of student knowledge of specific terms.

3. A study to determine the extent to which teachers make use of reading assignments is recommended. Such a study should include the time students actually spend on these reading assignments. How heavily do teachers rely on printed materials for teaching horticulture? How much time do students spend reading about horticulture and horticultural operations?

4. Comparing teachers receiving instruction in the teaching of reading with those not receiving such instruction would also be helpful. An experimental study could indicate the degree of usefulness of such instruction. Do teachers provided with information on reading and readability do a better job in helping individuals or groups of students with reading difficulties? Do teachers provided with such training make more use of reading assignments and supervised study? Do students receiving supplemental help

from teachers receive higher scores on standardized tests?

5. Comparing teachers' preferences for materials could provide valuable information. An experimental study could indicate whether teachers actually prefer more readable materials. Similarly, an experimental study could shed light on whether students prefer more readable materials. Will students spend more time reading materials which are less difficult? Are students more likely to complete reading assignments if materials are less difficult? Do students provided with materials which are easier to read receive higher scores on achievement tests?

REFERENCES

Aukerman, R. C. Reading in the secondary school classroom. New York: McGraw-Hill, 1972.

Beldon, B. R. Utilization of readability formulas for effective instruction. Stillwater, OK: Oklahoma State University, 1962. (ERIC Document Reproduction Service No. D 029 166)

Bentley, R. R. & Galloway, R. E. Comparison of the readability of vocational agriculture reference books with reading ability of students using them. Journal of Experimental Education. 1961. 29 373-383.

Bond, G. A. & Tinker, M. A. Reading difficulties, their diagnosis and correction. New York: Appleton-Century-Crofts, 1957.

Bormuth, J. R. Development of readability analysis. Chicago: University of Chicago, 1969. (ERIC Document Reproduction Service No. ED 029 166)

Calhoun, C. C. & Calhoun, M. R. Comparison of the readability level of high school bookkeeping textbooks with the reading achievement of bookkeeping students. Business Education Forum. 1968, 22, 21-23.

Dale, E. & Chall, J. S. A formula for predicting readability. Education Research Bulletin, 1948, 27, pp. 11-22; 37-54.

Dale E. & O'Rourke, J. The living word vocabulary. Elgin, IL: Field Enterprises Educational Corp., 1976.

Felsenthal, H. Readability: computer utilization. West Lafayette, IN: Purdue University, 1973. (ERIC Document Reproduction Service No. ED 079 702)

Miller, W. R. Readability versus reading ability. Journal of Educational Research, 1962, 56(4), 205-209.

APPENDIX

TABLE 8

RANK ORDER OF MATERIALS BY FREQUENCY OF USE

Number of times listed	Title of publication	Dale-Chall score	Type of material
	Materials listed 13 or more times		
23	Landscape Facts	10.8	EX
20	Introductory Horticulture	11.4	TX
17	The Nursery Worker, Part I	11.5	CG
15	The Ball Red Book	10.6	TD
15	The Nursery Worker, Part II	11.0	CG
13	Landscaping Principles and Practices	11.1	TX
13	Retail Floriculture, Book I	10.9	CG
	Subtotal = 7 publications	$\bar{X}$=11.0	
	Materials listed 7 to 11 times		
11	Retail Floriculture, Book II	11.2	CG
11	The Greenhouse Worker	11.1	CG
9	Horticulture	10.5	PP
7	The Garden Center Worker	10.4	CG

TABLE 8 (continued)

Number of times listed	Title of publication	Dale-Chall score	Type of material
7	Information Manual for Lawns and Gardens	10.5	TP
7	Florist (FTD)	11.3	TP
7	Florists' Review	12.2	TP
	Subtotal = 7 publications	$\bar{X}$=11.3	
	Materials listed 4 or 5 times		
5	Turf Management	12.1	CG
5	Bug Dope	9.4	EX
5	Pruning Landscape Plants	10.7	EX
5	Time-Life Encyclopedia of Gardening	10.3	ID
5	American Nurseryman	11.1	TP
5	Commercial Flower Forcing	10.8	TX
5	Working in Horticulture	10.9	TX
4	Landscaping Your Home	9.1	CG
4	Grower Talks	11.0	TP
	Subtotal = 9 publications	$\bar{X}$=10.0	

TABLE 8 (continued)

Number of times listed	Title of publication	Dale-Chall score	Type of material
	Materials listed 3 times		
3	Landscaping Your Home	10.4	TX
3	Shrubs for Landscaping	10.5	CG
3	Trees for Landscaping	10.3	CG
3	Tips for Growing Bedding Plants	11.9	EX
3	Diseases of Ornamental Plants	12.4	ID
3	Trees, Shrubs and Vines	12.1	ID
3	Ball Catalog	10.7	TD
3	Flowers (Teleflora)	10.6	TP
3	Flower and Plant Production in the Greenhouse	9.8	TX
3	Plant Propagation	11.8	TX
	Subtotal = 10 publications	$\bar{X}$=11.1	

CG = Curriculum guide
EX = Extension publication
ID = Identification manual
PP = Popular periodical
TD = Trade publication
TP = Trade periodical
TX = Text book

SUMMARY OF RESEARCH SERIES

Numerous items of teaching materials are utilized each school day by teachers of vocational agriculture to enhance the learning process. If the readability of these materials is not congruent with the students' level of understanding, then the materials may inhibit the teaching/learning process. This study gathered data concerning the readability of instructional materials used in Ohio vocational horticulture programs. The study should be of interest to curriculum material developers, researchers, teachers, teacher educators and others interested in enhancing student learning.

This summary is based on a Doctor of Philosophy dissertation by Antoinette Wojciak Welch under the direction of J. David McCracken. Dr. Welch is a Vocational Education Consultant, Ohio Agricultural Education, Curriculum Materials Service, The Ohio State University. Dr. McCracken is a Professor, Department of Agricultural Education, The Ohio State University. Special appreciation is due Christine D. Townsend, Assistant Professor, Department of Agriculture, Illinois State University; Gilbert A. Long, Department Head, Department of Agricultural Education, Utah State University; and L. H. Newcomb, Professor, The Ohio State University for their critical review of this manuscript prior to its publication.

Research has been an important function of the Department of Agricultural Education since it was established in 1917. Research conducted by the Department has generally been in the form of graduate theses, staff studies and funded research. The purpose of this series is to make useful knowledge from such research available to practitioners in the profession. Individuals desiring additional information on this topic should examine the references cited.

Larry E. Miller
Department of Agricultural Education

SR 31 1983